

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

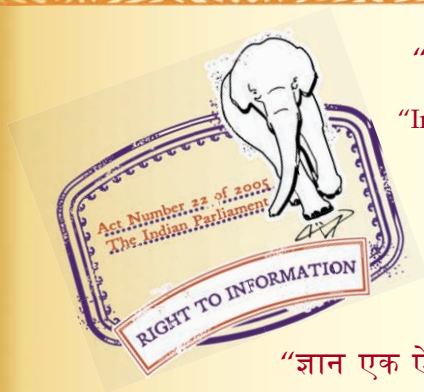
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 12761-4 (1989): Equipment for continuously monitoring radioactivity in gaseous effluents, Part 4: Specific requirements for iodine monitors [LITD 8: Electronic Measuring Instruments, Systems and Accessories]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



Indian Standard

**EQUIPMENT FOR CONTINUOUSLY
MONITORING RADIOACTIVITY
IN GASEOUS EFFLUENTS**

PART 4 SPECIFIC REQUIREMENTS FOR IODINE MONITORS

भारतीय मानक

**गैसीय बहिष्सावों में अपक्रांतिकता में लगातार
मानीटर करने के लिए भारतीय मानक उपस्कर
भाग 4 आयोडीन मानीटरों की विशिष्ट अपेक्षाएं**

UDC 621·039·76 : 628·512 : 546·15

© BIS 1990

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

*Indian Standard***EQUIPMENT FOR CONTINUOUSLY
MONITORING RADIOACTIVITY
IN GASEOUS EFFLUENTS****PART 4 SPECIFIC REQUIREMENTS FOR IODINE MONITORS****NATIONAL FOREWORD**

This Indian Standard, which is identical to IEC Pub 761-4 (1983) 'Equipment for continuously monitoring radioactivity in gaseous effluents: Part 4 Specific requirements for iodine monitors', issued by the International Electrotechnical Commission (IEC), was adopted by the Bureau of Indian Standards on 19 September 1989, on the recommendation of the Nuclear Instrumentation Sectional Committee (LTDC 26) and approval of the Electronics and Telecommunication Division Council.

Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

CROSS REFERENCES

In this Indian Standard, the following International Standard is referred to. Read in its place the following:

International Standard

IEC Pub 761-1 (1983) Equipment for continuously monitoring radioactivity in gaseous effluents: Part 1 General requirements.

Corresponding Indian Standard

IS 12761 (Part 1) : 1989 Equipment for continuously monitoring radioactivity in gaseous effluents: Part 1 General requirements.

Only the English language text of the International Standard has been retained while adopting it in this Indian Standard.

As in the Original Standard, this Page is Intentionally Left Blank

CHAPTER I: GENERAL

1. Scope

This standard is applicable to equipment intended for continuous monitoring of iodine in any gaseous form in gaseous effluents discharged to the environment.

It is applicable to equipment designed to fulfil the following functions:

- the measurement of the content of iodine in the gaseous effluents at the discharge point and its variation with time;
- the actuation of an alarm when a predetermined concentration of iodine or a total activity of discharged iodine in the gaseous effluent is exceeded.

The equipment may also be used for the determination of the iodine activity discharge over a given period.

2. Object

The object of this standard is to lay down specific standard requirements, including technical characteristics and general test conditions and to give examples of acceptable methods for the iodine effluent monitors defined in Clause 3.

The general requirements, technical characteristics, test procedures, radiation characteristics, electrical, mechanical safety and environmental characteristics are given in IEC Publication 761-1: Equipment for Continuously Monitoring Radioactivity in Gaseous Effluents, Part 1: General Requirements. They apply, unless otherwise stated, to this standard.

3. Terminology

For the purpose of this standard, the following additional definitions shall apply:

3.1 Iodine

Unless otherwise specified, the use of the word "iodine" in this standard covers radioactive iodine in all gaseous, vapour or aerosol forms whether chemically combined or not.

3.2 *Iodine effluent monitor*

Equipment designed for continuous monitoring of iodine in gaseous effluents discharged into the environment.

3.3 *Retention capacity*

The maximum quantity of a defined substance which can be retained at equilibrium in the medium considered.

4. Classification of iodine effluent monitors

The equipment may be classified according to the chemical type of measurement as:

- selective monitors for selective measurement of particular isotopes of iodine;
- selective monitors for measurement of particular chemical forms of iodine;
- non-selective monitors for overall measurement of iodine in all its forms.

The equipment may also be classified as a function of the mode of sample collection:

- equipment with static absorbent medium;
- equipment with moving absorbent medium.

CHAPTER II: IODINE EFFLUENT MONITOR DESIGN

5. Check source

Where a check source is supplied with the equipment it shall be, wherever possible, designed in such a way as to replace the iodine absorbent medium.

Any check source, when not in use, shall not increase the reading of the measurement assembly by more than 10% of the maximum value of the lowest useful decade of measurement.

6. Expression of measurements

In accordance with the requirements of Clause 10 of the IEC Publication 761-1, the electronic sub-assembly associated with the detector shall provide a reading expressed directly in the unit measured, for instance in counts per second or in amperes.

If, by agreement between the manufacturer and the user, the reading is expressed in units of volumetric activity or deposited activity in the collecting medium, the manufacturer shall state the calibration factors, the radionuclides and chemical forms of iodine for which they apply.

7. Ease of decontamination

As the sensitive surface of the detector will normally be in contact with the gaseous medium being monitored, special care shall be taken in the design to facilitate the decontamination of the detector head. Wherever possible, the detector head shall be protected by applying a thin screen that is easily interchangeable in front of the detector window.

8. Sampling and detection assembly

8.1 *Gas volume*

In order to minimize the effect of gaseous activity (Ar, Kr, Xe, etc.) liable to be present in the sample air, the detection assembly design shall be such as to minimize the volume of gas round the collecting assembly and detector.

8.2 *Inlet arrangement*

Where there are supplementary devices, such as temperature sensors, heaters, etc., these shall be easily removable for decontamination. It is also desirable that the manufacturer give recommendations on decontamination, for example the specification of decontamination solutions and their mode of use.

8.3 *Sampling and exhaust pipes*

In addition to the general requirements of IEC Publication 761-1, the following characteristics shall be considered and shall be agreed between manufacturer and user:

- the nature of constructional material, particular attention being given to electrostatic effects and chemical corrosion;
- the minimum distance between inlet and outlet to avoid recirculation;
- temperature control of the pipe run to prevent condensation.

8.4 *Inlet filter*

When appropriate, a filter may be placed in a filter holder at the sampling circuit inlet to remove any dust and aerosols. In order to maintain the specific performance of the equipment, such a filter shall not, as far as practicable, trap or even temporarily retain iodine (except in aerosol form).

8.5 *Iodine retention media*

- 8.5.1 Filters impregnated with special materials for the selective retention of iodine, or cartridges which contain such materials, may be used. Consideration shall be given to the use in the monitor of an alternative absorbing material to that used in the plant iodine absorption beds prior to sampling.
- 8.5.2 The dimensions and shapes of filters and cartridges may differ but shall be appropriate to the design of the equipment.
- 8.5.3 When a fixed absorbent is used, a quick and easy method of changing the filter or the cartridge shall be provided; which, nevertheless, shall not disturb the fixed geometry between absorber and detector.
- 8.5.4 The manufacturer shall specify the filter material and the retention devices for which his specification is applicable.
- 8.5.5 The manufacturer shall state, for the iodine compounds of interest, the efficiency of retention of recommended retention devices for the defined sampling conditions (temperature, humidity, flow rate, chemical contamination, etc.), as well as the effects of the variation of these conditions. The manufacturer shall also give references to justify such data.
- 8.5.6 The characteristics of the absorbent medium—efficiency, retention capacity and delay time constant—shall be known for the various radioactive gases of significance in the effluents.

CHAPTER III: TEST PROCEDURES

Except where otherwise specified, tests are to be considered as "type tests", although any or all may be considered as "acceptance tests" by agreement between manufacturer and user.

9. Standard test conditions

The standard test conditions are shown in Table I. These represent the values and tolerances of the various influence quantities for tests carried out with no variation of these values.

The tests carried out under standard test conditions are listed in Table II.

10. Tests performed with variation of the influence quantities

These tests are listed in Tables III and IV; they shall be carried out in accordance with Clause 24 of IEC Publication 761-1.

11. Test source

11.1 Reference sources

Tests for compliance with this specification shall be carried out with solid sources of appropriate geometry and applicable to the particular isotope which the equipment is designed to measure. For non-selective monitors the isotope ^{131}I may be used or its equivalent.

11.2 Accuracy of test sources

The conventionally true activity of the sources used shall be known with an accuracy of better than 10%:

$$\varepsilon_{\text{sa}} \leq 10\% \quad \varepsilon_{\text{sr}} \leq 5\%$$

In order to cover the whole of the scale of the measuring sub-assembly, several sources may be necessary. In this case the conventionally true activity of all sources of the same type may be calibrated in terms of that from one particular source which may be considered as the reference source. By this method, errors other than the intrinsic error of the assembly under test are reduced.

12. Radiation performance tests

These tests are carried out under standard test conditions and without air (or gas) flow.

If an electronic method of compensation against natural radioactivity is included, all the tests of the measuring assembly shall be performed with the compensation circuits in operation, after having been adjusted in accordance with the instructions of the manufacturer.

12.1 *Accuracy of response to the reference sources*

12.1.1 *Requirements*

Tests shall be carried out in accordance with Sub-clause 26.2 of I E C Publication 761-1, but to the accuracy requirements of Table II of this standard.

12.1.2 *Method of test*

The reference source shall be placed in the filter in a position defined by the manufacturer. The relative intrinsic error E , expressed as a percentage, shall be established for each test in accordance with Sub-clause 26.2.5 of I E C Publication 761-1.

12.2 *Response to other forms of iodine*

12.2.1 *Requirements*

If the equipment is designed to measure the activity of a particular chemical or isotopic form of iodine, its response to other forms of iodine shall be specified by the manufacturer but normally be less than 10% of the response to the form of iodine for which the equipment is designed.

12.2.2 *Test method*

The test method for other isotopes is identical with that described in Sub-clause 12.1.2 but using the other isotopes as appropriate.

Tests for response to other chemical forms of iodine, if required, shall be agreed between manufacturer and user.

12.3 *Response to radioactive gases other than iodine*

12.3.1 *Requirements*

The response of the equipment to designated radioactive gases other than the form of iodine which the equipment is designed to measure shall be stated by the manufacturer. The designated radioactive gases to which this requirement applies should be the subject of agreement between manufacturer and user.

12.3.2 *Test method*

Circulate air (or gas), labelled with a known activity of radioactive gas, through the assembly at a constant flow rate for a sufficient time to reach measurement equilibrium. Note the value at equilibrium.

13. **Tests of the air circuit**

In addition to the tests specified in Clause 29 of I E C Publication 761-1, the following tests shall be carried out.

13.1 *Leakage*

The test measures the external leakage but not the internal leakage around the holder of the iodine retention medium. A practicable quantitative method of test for internal leakage does not exist at present.

13.1.1 *Requirements*

The leakage of air or gas into the assembly upstream of the flow metering shall be less than 5% of the nominal flow rate.

13.1.2 *Test method*

The rate of leakage at the filter holder fitted with a clean filter shall be measured by means of two volume meters or flowmeters; these shall be calibrated relative to one another to better than 1%. One apparatus shall be placed upstream of the assembly and the other downstream of the filter holder and immediately upstream of the flowmeter incorporated in the assembly. For a series of ten consecutive measurements made at convenient time intervals (even after a heavy deposit) the mean of the measured upstream and downstream flows shall differ by not more than 5%.

CHAPTER IV: DOCUMENTATION

14. Type test report and certificate

With each equipment the manufacturer shall provide a certificate giving the following information in addition to that specified in Chapter IV of IEC Publication 761-1:

- the size and type of the retention filter and/or cartridge;
- response as a function of volumetric activity;
- response to reference source;
- response to the iodine compounds subject to monitoring;
- retention of the filter medium for the iodine compounds subject to monitoring;
- response to other forms of iodine, as appropriate;
- response to radioactive noble gases;
- response to external gamma radiation;
- background count rate of the assembly;
- nature, dimensions and effective area of the aerosol trapping device.

TABLE I

Reference conditions and standard test conditions

(Unless otherwise indicated by the manufacturer)

Influence quantity	Reference conditions	Standard test conditions
Reference radioactive source	A solid source of the appropriate form of iodine	A solid source of the appropriate form of iodine
Warm-up time — electronic devices — air or gas circuit	15 min 60 min	≥ 15 min ≥ 60 min
Ambient temperature	20 °C	18 °C to 22 °C
Relative humidity	65%	50% to 75%
Atmospheric pressure	101.3 kPa	86 kPa to 106 kPa*
Power supply voltage	Nominal supply voltage U_N	$U_N \pm 1\%$
Power supply frequency	Nominal frequency	Nominal frequency $\pm 0.5\%$
Power supply waveform	Sinusoidal	Sinusoidal with a harmonic distortion factor less than 5%
Gamma radiation background	Absorbed dose rate in air of $0.20 \mu\text{Gy.h}^{-1}$ ($20 \mu\text{rad.h}^{-1}$) at the detector	Less than absorbed dose rate in air of $0.25 \mu\text{Gy.h}^{-1}$ ($25 \mu\text{rad.h}^{-1}$) at the detector
Electromagnetic field of external origin	Negligible	Less than the lowest value causing interference
Magnetic induction of external origin	Negligible	Less than twice the value of the induction of the earth's magnetic field
Sampling rate	Adjusted to nominal flow rate (defined by manufacturer)	Adjusted to nominal rate $\pm 5\%$
Assembly controls	Set for normal operation	Set for normal operation
Contamination by radioactive elements	Negligible	Negligible

* Where the detection technique is particularly sensitive to variation in atmospheric pressure, the conditions shall be limited to $\pm 5\%$ of the reference pressure.

TABLE II

Tests performed under standard test conditions

Characteristic under test	Requirement	Reference (sub-clause)	
		IEC Publ. 761-1	IEC Publ. 761-4
Reference response	In accordance with the manufacturer's specification	26.1	
Accuracy of indication (E_I)	Less than $\pm 20\%$ or, for assemblies with linear scales, less than 5% of the activity corresponding to the maximum indication on the appropriate scale (whichever is least restrictive)	26.2	
Overload	To remain at full scale indication when exposed to an activity ten times that which would give full scale deflection	26.5	
Statistical fluctuations	Coefficient of variation less than 10%	27.1	
Stability of indication	Less than 10% of the full scale angular deflection over a period of 500 h on all ranges or less than 10% of indication for digital display	27.6	
Alarm-trip stability	Less than 20% of set point level over a period of 500 h	27.7	
Alarm-trip range	In accordance with Clause 13 of IEC Publication 761-1	27.8	
Equipment failure alarms	Low level alarm in accordance with Clause 13 of IEC Publication 761-1, other alarms by agreement between manufacturer and user	27.9	

TABLE III

Tests performed with variation of influence quantities

Influence quantity	Range of values of influence quantity	Limits of variation of indication	Reference (sub-clause)	
			IEC Publ. 761-1	IEC Publ. 761-4
Response to other chemical forms of iodine	In accordance with the manufacturer's specification			12.2
Response to radioactive gases other than iodine	In accordance with the manufacturer's specification			12.3
External gamma radiation from a ^{137}Cs source in defined source/detector geometry	Absorbed dose rate in air of $10 \mu\text{Gy.h}^{-1}$ (1 mrad.h^{-1})	In accordance with the manufacturer's specification	26.4	
External gamma radiation from ^{137}Cs source in other geometries	Absorbed dose in air of $10 \mu\text{Gy.h}^{-1}$ (1 mrad.h^{-1})	As specified, but normally less than twice that obtained under reference conditions	26.4	
External gamma radiation from other sources in the defined source/detector geometry	Absorbed dose in air of $10 \mu\text{Gy.h}^{-1}$ (1 mrad.h^{-1})	As specified, but normally less than twice that obtained under reference conditions	26.4	
Warm-up time	$\leq 30 \text{ min}$	$\pm 10\%^{1)}$	27.2	
Power supply voltage	From $88\% U_N$ to $110\% U_N$ (U_N = nominal supply voltage)	$\pm 10\%^{1)}$	27.4	
Power supply frequency	From 47 Hz to 51 Hz ²⁾	$\pm 10\%^{1)}$	27.4	
Power supply, transient effects	In accordance with Sub-clause 27.5 of IEC Publication 761-1	In accordance with Sub-clause 27.5 of IEC Publication 761-1	27.5	
Ambient temperature ³⁾	Indoor use: +10 °C to +50 °C Outdoor use: -10 °C to +40 °C -25 °C to +50 °C	$\pm 10\%^{1)}$ $\pm 20\%^{1)}$ $\pm 50\%^{1)}$	28.1	
Relative humidity	Up to 90% at 30 °C	$\pm 10\%$	28.3	
Atmospheric pressure	4)	4)		
Electromagnetic field of external origin	4)	4)		
Magnetic induction of external origin	4)	4)		

¹⁾ Of the indication under standard test conditions.

²⁾ For the United States of America and Canada: 57 Hz to 61 Hz.

³⁾ Assemblies intended for temperate climates. In hotter or colder climates other limits may be specified.

⁴⁾ No general specification. Range of value of influence quantity and limits of variation of indication to be specified if required.

Note. — For assemblies having non-linear scales, a linear instrument can be substituted for the indicating meter of the assembly to verify the performance called for by this table.

TABLE IV

Tests of air (or gas) circuit

(These tests are only applicable to assemblies whose response is dependent on flow rate)

Influence quantity	Range of variation	Limit of variation of nominal flow-rate	Reference (sub-clause)	
			IEC Publ. 761-1	IEC Publ. 761-4
Time	1 h to 100 h	$\pm 10\%$	29.1	
Pressure drop due to fouling of upstream filter	In accordance with the manufacturer's specification	-10%	29.2	
Power supply voltage	From 85% U_N to 110% U_N	$\pm 5\%$	29.3	
Power supply frequency	From 47 Hz to 51 Hz From 57 Hz to 61 Hz (for the United States of America and Canada)	$\pm 10\%$	29.4	
External leakages		The difference between the inlet and the outlet flow rates to be less than 5%		13.1

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act, 1986* to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

Revision of Indian Standards

Indian Standards are reviewed periodically and revised, when necessary and amendments, if any, are issued from time to time. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition. Comments on this Indian Standard may be sent to BIS giving the following reference :

Doc : No. LTDC 26 (1355)

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters :

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanstha
(Common to all Offices)

Regional Offices :

	Telephone
Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg NEW DELHI 110001	{ 331 01 31 331 13 75
Eastern : I/14 C.I.T. Scheme VII M, V.I.P. Road, Maniktola, CALCUTTA 700054	37 86 62
Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160036	2 18 43
Southern : C.I.T. Campus, IV Cross Road, MADRAS 600113	41 29 16
Western : Manakalaya, E9 MIDC, Marol, Andheri (East) BOMBAY 400093	6 32 92 95

Branches : AHMADABAD. BANGALORE. BHOPAL. BHUBANESHWAR. COIMBATORE.
FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR.
KANPUR. PATNA. TRIVANDRUM.